

1 I mean, that is not an answer to the  
2 question. It's just that it is a fact of life that  
3 we are facing. In addition, even if you have all  
4 the techniques in the world, and we are looking at  
5 in commercial wireless active interference  
6 cancellation techniques, and a lot of those  
7 criteria using the signal processing.

8 But to do that, again you have to know  
9 what it is that you are trying to go cancel. And  
10 the over the transom unknown signals become very  
11 difficult to address, and they become even more  
12 difficult to address because we are beginning to  
13 deploy technologies and techniques which don't lend  
14 themselves to readily tracing, or identifying, or  
15 characterizing those signals.

16 In the past when you had interference  
17 on a general basis that was a design deficiency, or  
18 another deficiency, and you could identify what it  
19 was, then you could take remedial steps for future  
20 products.

21 Unfortunately, it is becoming much more  
22 difficult to identify these. They are not single  
23 events. They are combinatorially events of  
24 interferences that are taking place. It is  
25 difficult to get inside of the digital front ends

1 on these radios to look at the signals real time.

2 You can't -- they are not a laboratory  
3 environment. They are out in the real world, and if  
4 as was pointed out they are the 3, 4, and 5  
5 percents out of a user base of millions, it  
6 directly affects the statistic when it is your  
7 device being perturbed.

8 But on the other hand, it becomes very  
9 difficult to find and apply a general solution. So  
10 it is an environment that perhaps more research,  
11 academic focus, as well as feedback on what we are  
12 seeing and finding, where we can all share against  
13 the knowledge of what we find, may be a useful way  
14 to look towards the future. Thank you.

15 DR. ROHDE: I hate to disagree with  
16 you. In some areas, simply I believe that in  
17 (inaudible), and for the same number of components,  
18 you can just build better receivers, and I have  
19 seen this.

20 It may not apply to you as an  
21 individual, as a company, but if you take the cost  
22 to parts count, there is no question around it.  
23 And whether you use those parts in an ingenious way  
24 or whether you use them in a sloppy way gives you  
25 two different results.

1           And I have seen enough cases where this  
2           is an excuse by saying, well, I don't know what is  
3           going on. In many cases, you do know what is going  
4           on, and in many cases it takes maybe two days longer  
5           to design it properly, but do it.

6           And again this may not be applicable to  
7           your particular case or your company, but I have  
8           seen from different manufacturers, and which I  
9           don't want to identify, where this is clearly the  
10          case.

11          So it is very dangerous to say I don't  
12          know what interference level I have, and I don't  
13          know what environment I have. There is certain  
14          rules of selectivity that are standard, and I think  
15          we use those that we are much better off.

16                 MR. WEINREICH:        Okay.     Thank you,  
17          Ulrich.

18                 MR. ENGELMAN:    I wanted to ask.   Many  
19          of your companies are not just U.S. players, but  
20          you are also involved internationally, and I would  
21          note that Europe has an EMC directive which places  
22          in standards which typically place requirements on  
23          both the transmitting and receiving side of things.

24                 Are those kinds of standards working  
25          differently in Europe? Is this less of a problem

1 in Europe, or is this a problem everywhere and not  
2 just the U.S.?

3 MR. WEINREICH: Ulrich. Go ahead.

4 DR. ROHDE: Well, the answer is clearly  
5 yes. The market is different. If you look at the  
6 symbols which you have on particular equipment to  
7 export it into Europe, you can clearly say that you  
8 have to meet much more stringent requirements.

9 And it is a question of economics, and  
10 whether you want to sell into the European market.

11 Then you have more stringent things. My company  
12 in Germany, with \$1 billion in sales, has a huge  
13 room in which you can actually drive a tank into.

14 And you can measure those -- the  
15 radiated and emitted energy, as well as  
16 susceptibility, gets to the top and you can measure  
17 these things. And this has a lot to do with the  
18 nations willingness to enforce certain things, and  
19 what the regulations are.

20 There is no question before I came to  
21 America and worked at AHE Telephone, which has now,  
22 as many other companies, has disappeared, I used to  
23 be in charge of handheld radios.

24 And this was a time when Motorola  
25 started to invade my domain by selling two-way

1 radios, and I actually did it quite well. And this  
2 was a time when the standard was lower because of  
3 political interference. Motorola put such pressure  
4 on the German government.

5 They wanted to enter this thing here  
6 that we had to rethink some of our policies. But  
7 at the time I will tell you that the standards were  
8 so extraordinarily tough that you couldn't take an  
9 off-the-shelf radio from anywhere in the country  
10 but Europe, or Germany in this particular case, and  
11 sell it. It was just totally different things.

12 And today I think even the Mercedes or  
13 BMWs still hold to a higher standard, and you pay a  
14 lot more money for those. And the initial  
15 engineering effort and everything is just more. It  
16 is less an average income device. It is more of a  
17 high income device.

18 And in radio, where the life depends on  
19 what you are doing, I think one should really look  
20 into these questions of quality and interference  
21 possibilities. That is an essential issue.

22 And if two policemen tried to talk to  
23 each other to save somebody's life, or avoid some  
24 bad crime, the ultimate judgment should be can they  
25 talk to each other and achieve their common goal,

1 and not whether they spend five cents less on the  
2 radio.

3 But this is a political issue, and you  
4 can see from my emotion, that different countries  
5 put different levels of efforts on that. And I  
6 just came back from Germany yesterday, where I was  
7 on a panel and saw these things.

8 It is highly political and emotional,  
9 and I am not sure that there is a clean answer.

10 MR. WEINREICH: Charlie.

11 MR. TRIMBLE: This whole issue of cost  
12 and ability to do things in electronics has come up  
13 over and over again. The fact of the matter is  
14 that the cost of electronic equipment drop at the  
15 rate of 30 percent a year.

16 And so it is really a case of only a  
17 year or so to meet any particular price point that  
18 you want to meet. Indeed, the NRE may be higher to  
19 do the job right, but the ultimate cost is not a  
20 major penalty, especially when you are taking a  
21 long term view.

22 MR. WEINREICH: Okay. Thank you,  
23 Charlie. Okay. I think we have come to the point  
24 now where I think we are going to ask at least my  
25 favorite question on the agenda, and that would be

1 what one rule or policy would you change or  
2 eliminate so as to improve spectrum efficiency.

3 So is there -- I will let Charlie go  
4 first.

5 MR. TRIMBLE: All right. I will be the  
6 lighting rod again. I would have the Commission  
7 take responsibility for monitoring the noise floor.

8  
9 MR. WEINREICH: Okay. So we have to  
10 have a new FCC bureau that is in charge of the  
11 noise floor.

12 MR. TRIMBLE: No, monitoring. They  
13 have got a feedback against their own decisions.  
14 They control a fair amount of it, and there is  
15 obviously some of it that they don't control.

16 MR. WEINREICH: Okay. Thank you. All  
17 right. Steve Gillig.

18 MR. GILLIG: Okay. I think we should  
19 have just one policy, and this is probably more,  
20 but I think the Commission needs to draft and  
21 encourage policies that promote cooperation and  
22 interworking between different radio access  
23 networks, like wireless LAN, and broadcast  
24 television, and cellular networks.

25 And they also need to encourage global

1 harmonization of the frequencies and the services  
2 that are using, because again the same problem that  
3 Ulrich brought up, is that without global  
4 harmonization, you can build a system and it will  
5 be just fine for one country, and then you have got  
6 a big problem on how to transition it.

7 MR. WEINREICH: Steve Blust.

8 MR. BLUST: I am going to say that I  
9 think on a longer term, I totally agree with the  
10 global harmonization and the aspect of looking at  
11 frequencies on a unified basis, globally, as well  
12 as domestically.

13 That comes from a lot of my background  
14 having done this for a number of years. On a  
15 nearer term basis spectrum efficiency, and I will  
16 speak specifically within the cellular industry, is  
17 the fact that even with inflexible use, we still  
18 have a criteria to maintain analog cellular.

19 And I think that we would like to see  
20 what it would take to move beyond having to  
21 maintain an analog cellular to where we can take  
22 the best advantage of deploying the advanced  
23 digital technologies on all the radio channels at  
24 our disposal. Thank you.

25 MR. WEINREICH: Thank you, Steve. It



1 sounds like we need some kind of -- like we said  
2 before, sunset rule on some of the older  
3 technology. Mr. Toh.

4 DR. TOH: I think the FCC should have a  
5 mechanism -- and I wouldn't say rule, but a  
6 mechanism where operators producing com systems to  
7 end-users should regularly provide technology and  
8 performance statistics, and as a result of trials  
9 and study feedback to the FCC.

10 If the FCC were to look through these  
11 various studies, and pinpoint out factors that  
12 would create problems, such as interference of one  
13 system to the other, and therefore take subsequent  
14 steps to rectify the problem.

15 But I think one issue would be how to  
16 you provide incentives to these people to prove you  
17 that feedback.

18 MR. WEINREICH: That's a question of  
19 how do you overcome some of the fear of  
20 compromising proprietary systems and property  
21 rights. Ulrich, please.

22 DR. ROHDE: I would still like to see  
23 that the FCC implement some kind of a working panel  
24 on technology, whereby we look at contributions on  
25 how to do certain things, whether on radio

1 receivers, front ends, mixers, oscillators, and how  
2 all of these things can be improved and shared on a  
3 working panel.

4 Because it is -- the word economic has  
5 popped up a few times today here, and rightly so,  
6 but I think if we come up with a common knowledge  
7 base about certain things and how to do them, and  
8 then there is still enough about how you package  
9 these things, and what features you implement,  
10 there is another chance around how you can make a  
11 better mouse trap.

12 On the other hand, I think there are  
13 certain commonalities, and I think we share certain  
14 commonalities, and avoid problems in both the  
15 receiving and transmitting.

16 And I wish that the FCC, as in the  
17 past, had gone out and said to ITT to build this  
18 better mouse trap. And I remember that ITT did one  
19 and then dropped it, and whatever happened there,  
20 it lasted for maybe a year or so.

21 I sent a letter to the people and asked  
22 can I have the integrated circuit and Texas  
23 Instruments said, well, we kind of dropped the  
24 ball. There was not enough interest.

25 So, yes, it was shown as demonstrated,

1 and it was built, and it worked, and IEEE wrote  
2 about it. So a magazine article came out of it.  
3 Texas Instruments got a good name out of it, but no  
4 product developed from it.

5 So what I wish that would happen is  
6 that the FCC really invites a bunch of experts on  
7 maybe a six months or whatever basis and talks  
8 about these issues, and how they solved these  
9 things, and everybody would greatly benefit from  
10 this.

11 MR. WEINREICH: Thank you, Ulrich. Mr.  
12 Rinaldo.

13 MR. RINALDO: Yes, thank you. It seems  
14 to be something often said these days in the FCC  
15 circles that you need technical flexibility, and  
16 there are times when that is wonderful, and there  
17 are also times when that causes problems.

18 If, for example, a number of services  
19 or a number of systems are put in a band under one  
20 set of circumstances, and now someone either new or  
21 an incumbent comes along and decides to use  
22 technical flexibility and changes the environment.

23  
24 Now, it is difficult to then figure out  
25 how to avoid that, but in some cases standards

1 should be considered, rather than having complete  
2 technical flexibility.

3 If someone -- if we all know the  
4 standards that are set for a new system coming in,  
5 and we are all talking to each other and studying  
6 that to see how it is going to affect the other  
7 systems, I think we are ahead rather than letting  
8 it happen, and then wondering what hit us.

9 So I would suggest that the concept of  
10 letting many flowers bloom is fraught with problems  
11 because eventually systems are going to collide,  
12 and then you have to do something about it.

13 So technical flexibility may be simply  
14 putting off the day when you have to develop  
15 standards. Thank you.

16 MR. WEINREICH: Thank you, Paul.  
17 Merrill.

18 MR. WEISS: I would say it is hard to  
19 verbalize this. I guess there is several aspects  
20 to technical flexibility that it seems to me ought  
21 to be implemented, and I guess this is more in the  
22 positive than in the negative. But maybe it is  
23 getting rid of some of the rigidity.

24 One of the things that we did in  
25 reconfiguring part of the spectrum some years ago

1 that would allow for spectrum efficiency was to  
2 allow for channelization that was flexible.

3 There were large blocks of spectrum  
4 that were assigned to or that were licensed to  
5 particular licensees, and then they could do with  
6 them as they saw fit, including combining adjacent  
7 channels, and then splitting them down into  
8 subchannels and things of that sort.

9 And so where I think most of the time  
10 when I hear people talking about technical  
11 flexibility, it is more in terms of modulization  
12 and things of that sort. It also needs to be done  
13 in the realm of channelization, and that requires  
14 that there be some mechanisms put in place as to  
15 how you go about calculating interference from  
16 unequal channels, unequal band widths, for  
17 instance, with overlapping channels.

18 And we actually developed a regime that  
19 allowed for that, and in part of spectrum, and it  
20 is in place today. But I think that could see  
21 application in other parts of the spectrum than  
22 where it is currently in place.

23 MR. WEINREICH: Thank you. I would  
24 like to ask members of the audience now to give us  
25 their opinion as to what one rule or policy should

1 be changed by the FCC. Carl. Down in the second  
2 row here.

3 MR. STEVENSON: Thank you, Dave. I  
4 realize that I am making a fairly significant  
5 number of comments, but I have a fairly large and  
6 vocal constituency that I am representing.

7 I have to agree with Paul's comment  
8 about standards. In fact, there is a Federal law  
9 on the books that the commission may or may not be  
10 fully aware of.

11 I believe it is called the "National  
12 Technology Transfer Act," and my understanding from  
13 reading some papers on the subject that came out of  
14 NIST are that regulatory agencies are required to  
15 consider open consensus industry standards in their  
16 regulatory proceedings.

17 We had a situation, which I think is  
18 what Paul is alluding to, where there are shared  
19 bands and there are the bands where you have Part  
20 15 devices, and the Commission has historically  
21 taken a very laissez-faire approach, a very  
22 technology neutral approach, in the sense of  
23 basically saying here is some basic power and  
24 emission limits, and here is the edges of the  
25 bands. Have a nice day. Thank you very much.

1           And what that has done in some sense is  
2     it has promoted proliferation of a lot of systems  
3     that are unlike, and in the standards community, we  
4     are going to great lengths to develop standards  
5     that will coexist with each other for different  
6     things, like wireless local area network, wireless  
7     personal area network.

8           We have listen before transmit, carrier  
9     sense     multiple     access,     collision     avoidance  
10    protocols, and all sorts of things like that, to  
11    allow our standards to work together pretty well  
12    and share the spectrum effectively with ourselves,  
13    and in many cases with unlike systems.

14           but it only takes one rogue if you  
15    will, who doesn't play nice for lack of a better  
16    term, to kind of upset the apple cart for  
17    everybody. So I would encourage the commission to  
18    make more use of industry consensus standards, such  
19    as those that IEEE 802 has developed for wireless  
20    networking, in defining the types of devices, and  
21    the types of requirements for devices for use in  
22    those sorts of environments. Thank you.

23           MR. WEINREICH: Marc.

24           DR. GOLDBURG: I would actually like to  
25    mention a policy that I think the commission

1 shouldn't change, which is the one of technical  
2 flexibility. If you look at other standards, or  
3 excuse me, other regulatory agencies throughout the  
4 world, you can see a number of cases where  
5 industries or economies have in some cases been  
6 severely damaged by the government trying to  
7 mandate technology.

8 Having said that though, it is  
9 important to come up with allocation rules that  
10 foster co-existence, and I think as you mentioned,  
11 a policy of sort of like versus like.

12 For example, putting wide area systems  
13 together, versus local area systems, or two way  
14 systems, versus broadcast systems, or FDD systems  
15 versus TDD systems.

16 With some basic groupings like that, I think one  
17 could develop a set of co-existence rules that do  
18 allow different technologies, but are meant to  
19 fundamentally provide the same types of services to  
20 co-exist.

21 MR. WEINREICH: Okay. Thanks, Marc.  
22 Anybody else? I'm surprised at the lack of  
23 comments here. Dr. Toh, please.

24 DR. TOH: Yes. Just to add on the  
25 standardization bodies. My knowledge is that



1 pretty much it evolved as a working group and  
2 eventually endorsed by, for example, IEEE, or TIA,  
3 and so on. Very often than not establishing a  
4 liaison with another standardization body is not a  
5 first criteria.

6 So the issues of who is going to  
7 encourage this formation, should that be the role  
8 of the FCC, or should that be the role of that  
9 evolving body. The second thing was brought out on  
10 the co-existent rule again.

11 As this community grew with different  
12 systems and different people controlling these  
13 systems, who should be the major player in terms of  
14 the co-existence, because obviously it affects  
15 their market, and it affects their control.

16 MR. WEINREICH: Thank you, Dr. Toh.  
17 Steve.

18 MR. BLUST: Another thing that I would  
19 like to mention is the globalization perspective,  
20 since that was brought up before. I think one  
21 thing that we have to be cognizant of is that  
22 perhaps we need to have increased, perhaps  
23 cooperative, government-industry research on a lot  
24 of these issues of common and core problems.

25 And that is not just a domestic issue

1 so to speak. That is an international issue,  
2 because while some systems are domestic in nature,  
3 and are only in the U.S. border so to speak, and  
4 not to mention the issues with neighboring  
5 countries at the borders, a lot of the standards  
6 that are being defined, and a lot of things being  
7 done, are for global bases, meaning your cellular  
8 PCS, third generation, and those sort of things.

9 And that we have to be careful that  
10 criteria that may be adopted here doesn't prohibit  
11 devices from either entry, or in use, or use and  
12 utilization elsewhere, because that is what the  
13 consumers are doing today in the mobility world.

14 And I think we have to ensure that we  
15 have that global dialogue in discussion, because it  
16 is a global problem. It may be in varying degrees  
17 in various jurisdictions, but the interference, the  
18 design, the criteria, all these questions that we  
19 are asking here, the efficiencies, and so forth, is  
20 of global concern, I believe, and that is my ITU  
21 hat so to speak on. Thank you.

22 MR. WEINREICH: I will just mention one  
23 other thing about the ITU. The GMPCS, the Global  
24 Mobile Personal Communication by Satellite  
25 memorandum of understanding was signed a few years

1       ago in the ITU, and people who do sign the  
2       memorandum are allowed to have their terminals  
3       passed freely amongst the countries that are the  
4       signatories to the memorandum.

5               And I think that was one thing that  
6       goes a long way to try and promote taking one  
7       terminal from one country to another. What you say  
8       about the mobility is I think compounded a little  
9       bit, in that we don't really have any common  
10      frequency bands around the world for us by PCS.

11             We tried it in Work 2000 to come up  
12      with something like that, but we weren't quite as  
13      successful as the industry wanted to be. But I  
14      think that is one thing that has to be taken into  
15      account in future spectrum planning, is to try and  
16      make a more global approach to the way the bands  
17      are assigned to the various services. Okay. Steve  
18      Gillig.

19             MR. GILLIG:     Just to add on that  
20      comment, and it also gets into what Mr. Weiss was  
21      saying, that having large bands is better than  
22      giving very small bands that are non-contiguous for  
23      the reasons of the technical flexibility, but also  
24      because it gives you a much better chance of having  
25      some overlapping spectrum with an around the globe

1 operation.

2           Whereas, if you have got very small  
3 bands, it gets very, very difficult to have any  
4 kind of global harmonization.

5           MR. WEINREICH: Thank you.

6           MR. ENGELMAN: Let's wrap up then.

7           MR. WEINREICH: Okay.

8           MR. ENGELMAN: I guess I would start by  
9 saying thank you for coming. I think we have had  
10 some good discussions this morning on spectrum  
11 efficiency. I want to thank our panel and my co-  
12 moderator, Dave Weinreich, for joining us.

13           I want to thank the audience for  
14 participating and would remind you that this  
15 afternoon we will have another session starting at  
16 one o'clock that will look more at the policies and  
17 rules that we currently have, and some of the  
18 philosophies associated with where our current  
19 rules are, and where they should be going in the  
20 future.

21           And we will also have a short  
22 introductory talk from Preston Marshall of DARPA on  
23 reconciling technology, flexibility, policies, and  
24 rules. I hope you will join us again at one  
25 o'clock. Thank you.

1 (Whereupon, at 11:56 a.m., the workshop  
2 was recessed.)  
3  
4  
5  
6  
7

## A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:05 p.m.)

MR. ENGELMAN: Welcome back. We will try to get started. I hope that you all had a restful lunch and you are ready for some lively post-lunch discussion. We want to keep things lively so that everyone stays awake.

And I don't think we will have a problem with that. We have got a great panel for you this afternoon, and first to kick us off, I would like to introduce our co-moderator, Preston Marshall, of DARPA, and not DARA. There is a "P" in there.

The project word is missing, but Preston, welcome.

MR. MARSHALL: Thank you. The P-word is important to us, because it brings us back to our internet inventor legacy. When Paul asked me to in fact replace him at DARPA to go over to the FCC to work on spectrum management, it was hard to imagine that he could really generate a lot of interest in that, and quite the contrary seems to be true as more and more people have recognized how central spectrum management is to doing IT.

I am sitting here as a representative

1 of DARPA, but it is important to realize that DARPA  
2 is a technology arm of the Department of Defense.  
3 It is our job to do the job that no one else would  
4 possibly invest in.

5 Nothing I say is anything other than my  
6 personal opinion on the kind of technology inputs.

7 If you want to know policy from DoD, go over and  
8 see Steve Price and testimony, and they can work  
9 that for you. I am here just as a technologist.

10 And this is an area where we really  
11 think is amenable to technology. I tried to put in  
12 a topic sentence for this session, and I had a  
13 Blackberry keyboard and so I had to keep it short.

14 Reconciling Technology, Flexibility, Policies, and  
15 Rules.

16 Now, the policies and rules came from  
17 Paul, and that was the title of the group, but the  
18 issue really seems to be how to reconcile the kind  
19 of technology that everyone sees emerging,  
20 particularly in the other panels.

21 And the kind of flexibility we want to  
22 see in systems, and how to reconcile those two with  
23 something that can be implemented in a policy and  
24 rule base. I think as engineers, a lot of us have  
25 a strong sense that if we could just go in and do

1 it, we know how we would have to do it.

2 But going from that very specific case  
3 to a general case of policies and rules, which is  
4 to challenge everyone else who enjoys criticizing  
5 the FCC for really is a job.

6 We are one of the last panels, and so a  
7 lot of panels have talked about ideas. I would  
8 hope that when we are finished that we can come up  
9 with some ideas that are implementable, that  
10 capture the intellectual content of those, but  
11 still in a form that someone can carry forward and  
12 actually implement.

13 To start up the sort of dissention and  
14 hope to keep it interesting, I thought I would take  
15 the preoperative of being the moderator, and throw  
16 a couple of things on the table.

17 The panel was set up with the framework  
18 of policies and rules, and it is hard to argue  
19 against policies. We need them. We can't have  
20 anarchy in spectrum. I would like people to think  
21 about whether though we need rules.

22 Rules implement policy. We ought to be  
23 looking towards a period of time when our radios  
24 are smart enough, our interference management is  
25 smart enough, so we can give the radios directly



1 policy, and get the FCC out of the rules business.

2 We think today about a policy framework  
3 which locks in the characteristics of radios. I  
4 think we need to be moving towards a framework  
5 where we lock in the behavior of radios, and how  
6 they respond, and make sure that they behave  
7 correctly to interfering conditions. But not to  
8 necessarily avoid those conditions.

9 So, my first sort of charge to the  
10 group, both audience and panel members, is that  
11 when you think about rule making and policy making,  
12 think about it as something that controls action,  
13 reaction, response, sensing, rather than something  
14 that merely guarantees that nothing can ever  
15 interfere at any point in time, and at any point in  
16 space, and at any point in the earth. And  
17 potentially if NASA was here, the solar system.

18 The second thing is I listened to Vince  
19 Cerf a couple of days ago. Vince Cerf is probably  
20 the most famous DARPA program manager and inventor  
21 of the internet.

22 And his comment was that you ought to  
23 look at whatever we did as being wrong, because we  
24 responded to a very different set of engineering  
25 realities, and we could build very different kinds